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RANDOM SUBSTITUTION: THE CASE OF GLIDING

The aim of the paper is to examine a single case of random substitution which consists in the replacement of liquids by glides, that is, gliding. This process occurs in both English and Polish and it affects children's speech as well as the speech of those adults who did not acquire the proper pronunciation of liquids. We address the following questions: is the substitution really random, why in the majority of cases it results in glides and not in something else, what is the relationship between two articulatorily distant segments which allows them to participate in substitution, among many others. It is argued that some examples of gliding can be analysed as a simple reduction in the elemental make-up of segments, e.g. [l] ~ [w], others like English [r] ~ [w] can be the effect of phonetic enhancement sometimes called phonological reinterpretation.

1. Introduction

Unmotivated developments, which can also be called 'random substitutions', are common phenomena recorded in the phonological literature. This term is usually applied to describe a situation when a segment which is a target of a change is not related to a segment occurring as its result. In other words, the input and output segments are quite distant phonologically and phonetically. Crucially, the change cannot be explained by the context either.

Although marked, the unmotivated developments in traditional rewrite-rule analyses have been explained as a simple manipulation of binary-valued features. Such an explanation, however, suffers from many weaknesses, e.g. arbitrariness, overgenerative power, unnaturalness, and many others (Harris 1994: 6ff). In more constrained models such as Element Theory (ET), random substitutions, as impossible, are not recognized at all. This is the result of a heavily constrained character of the model. There are two basic operations affecting segments in ET: addition and deletion. In a latter case, a segment undergoes a change as a result

of deleting or subtracting one or more elements from its internal structure. In the former scenario, a segment acquires an element from neighbouring segments by means of spreading. A situation when a segment acquires an element that is not present in the close vicinity is recognised as problematic. In order to account for such cases other solutions must be sought.

In ET elements have double linkage: they are associated with physical patterns in the acoustic signal and also with segmental representations in the mental grammar. Since language users have the ability to filter out the elements, that is relevant acoustic patterns, from the speech signal during language acquisition and communication, the extracting mechanism may and does often lead to misinterpretation (see section 4.1 below). In what follows we look at one particular example of substitution, the one which results in gliding. The process in question, occurring both in English and Polish, affects young children's speech as well as the speech of those adults who did not acquire the proper pronunciation of these sounds, e.g. Polish *zbiór* [zbjul], *krew* [kjɛf] and English *hurry* [hʌwi] and *doll* [dɔːj] or [dɔːw]. Although a few solutions have already been proposed, e.g. Bloch-Rozmej (2011), still some persistent questions remain. In this paper we address some such questions and propose an analysis of gliding within ET model. It is concluded that gliding, rather than being a homogeneous process, is triggered by several mechanisms: misinterpretation, element addition or reduction. The following section provides us with some examples and a detailed discussion of gliding. In Section 3 we look at the elemental make-up of glides and liquids. Section 4 analyses the process in question and discusses the solutions available within the ET framework. Section 5 summarizes the findings.

2. Gliding in young children's speech

In this section we look at one example of random substitution which is particularly characteristic of young children's speech, that is, gliding. The search for the factors determining the change in question is based on the data from the first language acquisition (both Polish and English) collected by Bloch-Rozmej (2011) and, to a lesser extent, Backley (2011). As for the process itself, it consists in a seemingly random substitution of certain consonantal features like, for example, the place and/or manner of articulation. In other words, the consonants involved in the replacement are relatively distant phonetically. For example, a very common pattern found among children boils down to the substitution of the liquids [l] and [r] with the glides [w] and [j]. As noted in section 1, this process is exhibited by both Polish and English children at the age between 1,5 and 4 and also by adults who did not acquire the proper pronunciation of these sounds by the end of the critical period for the development of liquids, that is by the age of 5 or 6.

As noted in Inkelas and Rose (2003) and Bloch-Rozmej (2011) the random substitution may depend on the inability to pronounce certain sounds as the

consequence of the retarded development of the speech organs. It may as well be phonologically based, i.e. it may be the result of the unequal pace in the acquisition of particular phonological primes (Bloch-Rozmej 2011).

Consider first some examples illustrating the substitution in Polish (1a) and English (1b). The examples have been adopted from Bloch-Rozmej (2011: 98) and Backley (2011:171).

(1) Random substitution: *gliding*

a. Polish

rok	[jɔk]	‘year’
królik	[kjulik]	‘rabbit’
korek	[kɔlek]	‘traffic jam’
bar	[bal]	‘pub’
król	[klul]/[kjuj]	‘king’
lina	[(j)ina]	‘rope’
lalka	[jajka]	‘doll’

b. English

rabbit	[wæbɪt]	or	[jæbɪt]
risk	[wɪsk]	or	[jɪsk]
rock	[wok]	or	[jok]
parent	[peəwənt]	or	[peəjənt]
hurry	[hʌwi]		
train	[tweɪn]		
ball	[bɔːj]		
doll	[dɔːw]	or	[dɔːj]

The examples in (1a) show that the rhotic in Polish is replaced by either a lateral, e.g. *korek* [kɔlek] ‘traffic jam’ or the palatal glide, e.g. *królik* [kjulik] ‘rabbit’. The lateral, on the other hand, becomes substituted by the palatal glide, e.g. *lalka* [jajka] ‘doll’. In English (1b) the gliding affects both [r] and [l] which turn up as either [j] or [w], e.g. *rabbit* [wæbɪt]/[jæbɪt] and *doll* [dɔːw]/[dɔːj]. As noted in Bloch-Rozmej (2011:99), there are some examples of complete [l] deletion which primarily occurs in the word-initial position before [i]. Moreover, it has also been observed that [r] is replaced with the lateral only in the final phase of its acquisition, especially in intervocalic or postvocalic positions, e.g. *kolorowy* [kɔlɔlɔvɨ] ‘colourful’ or *stary* [stalɨ] ‘old’.

In a nutshell, in Polish the liquids [r] and [l] are predominantly replaced by glides. Interestingly, there is one additional pattern found in this language – a liquid may be replaced by another liquid, that is, [r] becomes substituted by [l]. The reverse pattern has not been recorded in the collected data. In English, on the other hand, the pattern is slightly different. Thus, although the liquids

are also the targets of the substitution, they are replaced by the glides only. It means that in English the liquids [r] and [l] can only be replaced by [j] or [w], e.g. *rabbit* [wæbɪt]/[jæbɪt] and *doll* [dɔːw]/[dɔːj]. The choice of a given glide, in both languages, seems to be child specific. Before we look at the gliding through the prism of Element Theory in section 4, we should first provide the reader with the basic tenants of the model and discuss the internal structure of segments involved in the substitution.

3. Element Theory

Element Theory holds the view that phonological segments are built out of privative cognitive units called elements. Elements are directly associated with the acoustic signal and this view stands in a sharp contrast to the traditional one in which (binary) features are based on articulatory or auditory properties. It follows that elements play a double role as both mental and physical objects. It other words, elements function as 'abstract units of phonological structure which carry linguistic information about segments' and, at the same time, 'they connect to the physical world through their link with acoustic patterns in the speech signal' (Backley 2011:5ff). A clear advantage of this proposal is that ET concentrates on the knowledge of both the speakers, who use their speech organs to form sound patterns in the acoustic signal, and hearers, who recover and decipher these patterns from the speech signal. Another, no less important, consequence is the observation that the primary role of elements is to inform the speakers WHICH patterns they should aim to reproduce and not HOW they should reproduce them. Thus it is only through experimentation and experience that children learn how to articulate the sounds of their native language. It means that 'speech production is not controlled by the grammar – tongue position, glottal state, lip position and the like are not part of linguistic knowledge. They function as a vehicle for delivering the speech signal and for carrying the linguistic message' (Backley 2011:6). Since infants filter out the elements from the acoustic signal this may, and often does, lead to misinterpretation or enhancement of certain patterns the effect of which is substitution.

3.1. Liquids and glides

Since Element Theory is a relatively new model in segmental phonology, it is often the case that radically different views on the character and number of elements struggle for dominance within this approach[1]. All ET researchers,

[1] For more information and an ongoing discussion concerning the elemental make-up of phonological segments the reader is referred to, for example, Harris and Lindsey (1995), Charette and Göksel (1996), van der Torre (2003), Scheer (2004), Botma (2004), Bloch-Rozmej (2008), Cyran (2010) and Backley (2011) among others.

however, agree that the same elements which are used to describe vocalic systems are also active in consonants. Thus the three resonance elements |I|, |A|, |U| defining vocalic segments are active place definers in consonantal systems. In order to fully describe the latter, however, some additional primes are required and these are |L|, |H| and |ʔ|.[2]

Elements are granted autonomous interpretability which simply means that they are large enough to be phonetically interpretable when they occur alone in a segment. Thus, for example, a single element |I| linked to a nuclear slot is realized as the vowel [i]. The same element attached to the onset position is pronounced as the glide [j]. Crucially, elements may combine with one another and appear together in a single melodic expression. For example, the two mid vowels [e] and [o] are combinations of |A I| and |A U|, respectively. Finally, in still richer vocalic systems, it is headedness that is utilised to mark certain contrasts. This is the case in, for example, English where the contrast between the front mid vowel [e] and the front open vowel [æ] is represented by means of headedness. Both vocalic expressions contain identical elemental make-up, i.e. |A I|, with the difference that [e] is headed by |I| while in [æ] the role of the head is played by the element |A|.

In most of the segmental analyses, glides are represented by resonance elements only. Thus, it is a generally hold view that [j] and [w] are simplex expressions containing the elements |I| and |U| respectively.[3] However, when it comes to liquids opinions are far from unanimous. Recently, it has been proposed that liquids, similarly to glides, are built out of resonance elements only. For example, Backley (2011:165ff) provides some convincing arguments for the idea that liquids and glides belong to a natural class. More importantly, he postulates a similar structure for them. In short, it is claimed that in most of the languages liquids just like glides are melodic expressions represented by resonance elements. Since glides are defined by |I| and |U|, liquids must be |A| consonants. Whereas rhotics are analysed as simplex |A| glides, most laterals are represented as complex glides including |A| and another resonant. The additional resonance element may be either |I| or |U| depending on the language and the phonological context. It follows that laterals are complex glides with a structure |A I| or |A U|.

One of the most commonly used arguments for the glide status of [j] and [w] in English is the *liaison* phenomena found in this language. Consider the representation of glide formation illustrated on the example *high*[j]*est* and *do*[w]*it* in (2) below.

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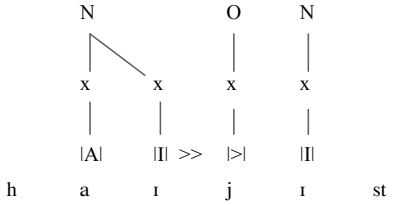
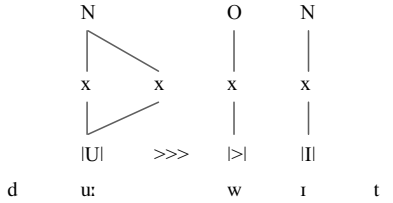
[2] The consonantal elements can also occur in vocalic expressions representing secondary properties such as tone, nasality or creakiness (Backley 2011).

[3] Elements will be marked for headedness only in a situation when relevant to the discussion.

(2) a. *highest* [haɪjɪst]

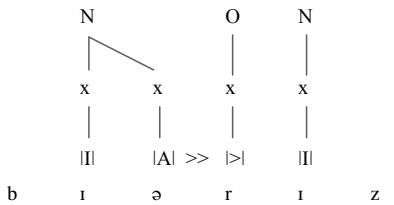


b. *do it* [duːwɪt]

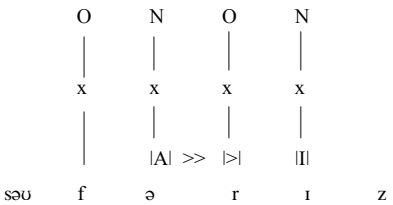


In (2a) the element |I| which is part of the diphthong [aɪ] spreads to the following empty onset where it is interpreted as the glide [j]. Similarly, in (2b) the element |U| representing the high back vowel spreads and gets interpreted as [w] in the following onset. The argument goes that if the resonants |I| and |U| can form glides, the remaining vowel element |A| is expected to do the same. In other words, if [j] and [w] can trigger glide formation, liquids, defined by |A|, should also be active glide triggers. This prediction is corroborated by the phenomena of linking and intrusive *r* found in some varieties of English (Broadbent 1991, Kijak 2010, Backley 2011). Consider the representations of *bee*[r]*is* and *sofa*[r] *is* in (3) illustrating the processes in question, that is, linking and intrusive *r*, respectively.

(3) a. *beer is* [bɪərɪz]



b. *sofa is* [səʊfərɪz]



In (3), similarly to (2) above, the mechanism responsible for glide formation is spreading. Non-high vowels, including the schwa, contain the resonant |A| which in favorable conditions spreads to a neighbouring onset position and is realized phonetically as [r].[4]

To sum up the discussion so far, rhotics and glides are composed of resonance elements. They are represented by a single element |I|, |U| or |A|. It has also been noted above that the second liquid, that is the lateral, is more complex. This segment is usually represented by |A| plus another resonant |I| or |U| which gives us two melodic expressions, i.e. |A I| and |A U|. Furthermore, the liquid, just

[4] The idea that English *r* should be represented by the element |A| has been confirmed independently by some historical processes, see Kijak (2009).

like the rhotics, belongs to the group of glides[5] as it can trigger some processes characteristic for this group, e.g. linking and intrusive *l* in the English dialects of Pennsylvania or Bristol (Gick 2002, Kijak 2010 and Backley 2011). In Backley's (2011) account, two common variants of the lateral, i.e. clear and dark *l*, are given separate representations. Since clear *l* is coronal, it contains the elements |A I|. The velarized or dark *l*, on the other hand, possesses two characteristics: coronal and velar and should be represented accordingly as a combination of |A U|. Contrary to the standard analyses, Backley (2011:178) suggests that the distribution of clear and dark *l* in the varieties of English maintaining the difference between both variants depends on the following conditions: clear *l* occurs before front vowels and [j] as they contain |I|, e.g. [ɪ, e, æ, iː, eɪ, ɪə]. The dark variant occurs in all other contexts. The conclusion drawn from the above discussion is that English *l* is represented as |A U| but in a context of the following |I| vowel it gets reorganized into |A I| as the result of spreading. In short, |U| is replaced by the incoming |I| element which results in the clear variant |A I|.[6] Having discussed the elemental make-up of glides and liquids, we are in a position to explore the cases of substitution illustrated in section 2 above. This is done in the immediately following section.

4. Element Theory account of substitution

When viewed from the phonetic perspective, the phenomenon of gliding looks rather trivial and hence uninteresting. This naïve conclusion may result from the observation that all the consonants participating in gliding belong to a class of oral sonorants. Thus, their free fluctuation, the argument goes, is fairly interesting but definitely unsurprising. On closer inspection, however, a number of problems emerge. For example, is the random substitution really random if in the majority of cases it results in glides, why is it the glides that predominantly replace liquids and not something else, what sort of relation exists between two articulatorily distant segments that allows them to participate in substitution. The latter puzzle may be exemplified by a common substitution of English [r] with [w] where both segments differ quite drastically in the place of articulation.

In order to better understand the mechanism of substitution, we should begin with a brief review of the solutions available in different theoretical models. The first and a somewhat intuitive choice is a solution which relies on the sonority hierarchy. Note that liquids are less sonorous than glides and so it could be claimed that children choose a more sonorous, vowel-like segment. This

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[5] Laterals can also pattern with stops in some languages which means that in those systems they may contain additional element |ʔ|.

[6] In English, just as in some other languages, the combination of |I| and |U| is inactive, i.e. they do not co-occur within a single melodic expression. One of the consequences of this ban is the lack of front rounded vowels in the vocalic system of English.

solution, however, contradicts the observations which clearly demonstrate that the least sonorous consonants are among the first segments acquired by children, for example, plosives. Without going into specific details, it is generally agreed that less sonorous sounds are acquired before the more sonorous ones. It follows that sonority hierarchy fails to provide a convincing explanation for substitution. Furthermore, since liquids are of the same sonority, this solution cannot explain why in Polish [r] is commonly replaced by [l] and why this pattern is not found in English. Some similarly difficult questions that the sonority hierarchy solution would have to face are, for example, why in the latter language the lateral [l] becomes substituted by [j] or [w] but in Polish [w] is not among the glides replacing the liquids, among many others.

Another candidate for the solution, i.e. the model based on complexity, suffers from the same weaknesses. As rightly pointed out by Bloch-Rozmej (2011:97), it cannot be claimed that the reason why children replace liquids with glides is that the latter are less complex and hence easier to articulate and/or acquire. Recall from section 3.1 above that in ET glides are simple structures containing only a single resonance element, that is, [j] and [w] are represented by a single element |I| and |U| respectively. Although, at first sight, this line of thinking seems to be on the right track as the lateral contains two elements, i.e. |A I| or |A U|, it has to be abandoned as the rhotic is represented as a single-element segment (see section 3.1 above). Note again that in Polish a less complex segment [r] becomes substituted by a more complex one [l]. Even worse, the idea that complex segments are more difficult for children and consequently they are acquired later is simply incorrect. As mentioned above, plosives are among the first segments acquired by children and they are complex melodic units. Since plosives belong to the group of complex segments and they are acquired relatively early, it cannot be the case that it is complexity that triggers substitution. When looked at from the complexity perspective, it should be the lateral that substitutes the glides.

The most promising solution, the one put forward in Bloch-Rozmej (2011), is based on the strength hierarchy of elements. On the basis of the analysis of two processes in young children's speech, i.e. gliding and fronting, she comes to the conclusion that it is the strength of particular elements that is responsible for random substitutions. She further claims that the elements |I| and |U| are stronger than |A| and hence the latter is acquired later than the former. The strength hierarchy proposed by Bloch-Rozmej (2011) can explain some of the patterns illustrated in (1a-b) above and although we apply this solution to our analysis, we believe that it can be refined to cover some problem areas like, for example, some additional options found in one language but not in another, e.g. the replacement of [r] by [l] in Polish or the substitution of a liquid by [w] in English.[7]

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[7] It should be borne in mind that the concept of strength hierarchy has always been under the severe fire for being merely a look-up scale. Moreover, it has not been decided yet what form should it have in lexical representation (see Harris 1994, Scheer 2004 and Cyran 2010).

Following Bloch-Rozmej (2011), we argue that the strongest element is |I| which is readily used to replace |A| – the element at the bottom of the strength hierarchy. If true, this assumption can explain why in both languages [r] represented by |A| can be replaced by [j] – the |I| segment. We further propose that in Polish the replacement of the second liquid by the palatal glide, that is [l] > [j] is the case of element reduction. In other words, the substitution is the result of the element loss, that is, [l] |A I| becomes [j] |I|.[8] Note that it is the element |A| which is lost. Another pattern characteristic for Polish is the situation when one liquid becomes substituted by another liquid, i.e. [r] replaced by [l]. From the perspective of the solution advocated here, it may seem a somewhat counter-intuitive change as a less complex segment becomes substituted by a more complex one. It has already been noted, however, that more complex segments seem to be less problematic for children in the acquisition process. Thus, what we are faced with here is a situation when a strong element |I| does not replace the weaker element but is simply added to the internal structure of [r] which gives [l], hence |A| becomes |A I|. Summing up the discussion so far, substitution in Polish is based on the strength of the element |I| which can either replace the weaker |A| or it may be added to the already present |A| element. The latter scenario is characteristic for children who have mastered the production of [l]. Finally, there is another option available in the language – the loss of the weak element which explains the substitution of [l] by [j]. The substitution of liquids by the palatal glide in English is given identical explanation, i.e. weaker elements (note that the liquid in English is represented by |A U|) are replaced by the strong |I|, hence [r] |A| and [l] |A U| become [j] |I|. However, English liquids, in opposition to Polish, can also be replaced by the second glide, i.e. [w]. First note that given the representation of the English lateral, the [l] > [w] replacement is fairly natural. This is another case of element loss – [l] |A U| > [w] |U|. Similarly to Polish, it is the result of decomposition where the weak element |A| is suppressed and we are left with |U| interpreted phonetically as [w]. The final pattern, i.e. the substitution of [r] by [w], is a more complex case. Thus, before it is analyzed, we should first, rather briefly, mention the case of phonological reinterpretation proposed by Cyran and Nilsson (1998).

4.1. Phonological reinterpretation Cyran and Nilsson (1998)

In order to account for the historical shift [w] > [v/f] in Slavic, Cyran and Nilsson (1998) discuss a possibility of the addition of the locally absent element. Quite uncontroversially, they consider the [w] > [v/f] shift as the example of fortition which consists in the addition of some consonantal material. However, this development is peculiar in that in many cases it is not possible to find a local donor for it, e.g. Polish [voda] ‘water’. Therefore the solution they propose

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[8] In Bloch-Rozmej (2011) the representation of the liquid contains the resonant |A| and occlusion |ʔ|, hence it differs from the one used in this analysis.

includes two stages. The first step consists in the shift [w] > [v] = |U| > |U|. Building on the findings in Irish (Cyran 1996, 1997), Cyran and Nilsson (1998) assume that headedness of the resonance element may bring out audible friction in consonants. The second step of the development involves obstruentisation, that is, [w] > [v] > [v/f]. In other words, what we are dealing with here is a phonological reinterpretation which consists in assigning a phonological status to phonetically present properties, i.e. the friction and voicing included in |U| are assigned a phonological status, that is, |H| and |L|, hence, |U| > |U H L|.

Recently, a similar example of misinterpretation and its consequences on the internal structure of segments has been reported by Backley (2011: 170ff). However, the case discussed by Backley (2011) is slightly different in that it does not describe a historical change but rather a process in the first language acquisition. In short, he discusses a situation in which a child concentrates on and reinforces the acoustic pattern which is not a lexical property of a segment. Without going into specific details, it has been pointed out (Backley 2011) that since English [r] and [l] are acoustically similar and may be difficult to distinguish, language users enhance [r] through lip rounding. This, it is claimed, lowers F3 in [r] and in consequence boosts the contrast with [l] which has an unusually high F3. In this way the phonological difference between [r] and [l] is reinforced and they are perceived by listeners as two distinct sounds. Backley (2011:171) further argues that during the acquisition period, children concentrate on the acoustic patterns in order to form lexical representations. It follows that because children can hear the lowering of F3 produced by lip rounding, they intuitively assign [r] the representation |U|. It means that here, just like in the case of [w] > [v/f] described above, the change (substitution) is triggered by misinterpretation. Obviously as the children's phonological awareness increases, they realize that |U| is not part of lexical property of [r] but it functions merely as an acoustic enhancement.

Summing up the discussion concerning the replacement patterns found in English, we have seen that, similarly to Polish, substitution can be triggered by at least three different mechanisms. The unity of all the three patterns is achieved by the assumption that the element |A| is at the bottom of the strength hierarchy. Thus, it can be replaced by the strong |I|. This situation is exemplified by two substitutions: [r] > [j] and [l] > [j]. Furthermore, the element |A| may be simply lost from the internal structure of the lateral. This is the case in [l] |A U| > [w] |U| substitution. Note that this pattern is not found in Polish simply because the lateral in Polish does not contain the element |U|. Finally, the complex acoustic signal in [r] may be misinterpreted as |U|, hence [r] |A| > [w] |U|. All available patterns have been collected and represented graphically in the form of table in the concluding remarks below.

5. Conclusions

In this paper we have argued for the non-homogenous character of gliding in Polish and English. It has been proposed that gliding is best analyzed as a variety of mechanisms observing the element strength hierarchy. All the mechanisms discussed in this paper, along with the examples, are provided in table 4 below.

(4) Gliding in Polish and English

	Gliding	
Mechanism	Polish	English
Segment substitution	[r] > [j] ***r***ok [**j**ɔk] ‘year’ k***r***ólik [k**j**ulik] ‘rabbit’ k***r***ól [k**j**uj] ‘king’	[l] > [j], [r] > [j] ba***ll*** [bɔː**j**] ***r***isk [**j**ɪsk] do***ll*** [dɔː**j**] ***r***ock [**j**ɒk] ***r***abbit [**j**æbɪt] pa***r***ent [peə**j**ənt]
Reduction	[l] > [j] kró***l*** [kju**j**] ‘king’ ***l***ina [**j**ina] ‘rope’ ***l******a******l***ka [**j**a**j**ka] ‘doll’	[l] > [w] do***ll*** [dɔː**w**]
Element addition	[r] > [l] ko***r***ek [kɔ**l**ek] ‘traffic jam’ ba***r*** [ba**l**] ‘pub’ k***r***ól [k**l**ul] ‘king’	
Misinterpretation		[r] > [w] ***r***abbit [**w**æbɪt] pa***r***ent [peə**w**ənt] ***r***isk [**w**ɪsk] hu***rr***y [hʌ**w**i] ***r***ock [**w**ɒk] t***r***ain [t**w**eɪn]

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